congruity, indicating past migrations over the area. The time involved is probably very great, and it does not seem necessary to postulate continuity of land at any particular period from one end of the Polynesian group to the other.[1]

In dealing with the color-variations, Crampton proposes special names, "not of taxonomic significance." Hence he gives the name *strigata* to a particular form of *P. radiolata*, although it was earlier named *rushii* by Pilsbry. The names of the color types are similar to those employed elsewhere, especially in Europe, for what are called varieties. It does not appear possible to regard them as outside taxonomy, and there is no warrant, under the present rules, for disregarding priority. At the same time, it might be possible and desirable to eventually establish a sort of code of names for such variations, requiring the same designation to be employed for parallel variations of different species. Even so, the names should be formally proposed and type specimens preserved, or uncertainty will result.

REVERSED LYMNAEA PEREGRA[2]

BY T. D. A. COCKERELL

Jules Verne, who knew well how to dramatize natural history, was well aware of the wonder and interest excited by reversed coiling in shells. In his *Twenty Thousand Leagues*

[1] Dr. P. Marshall, in his address before the Australasian Association for the Advancement of Science, published in 1912, concludes that bathymetrical, structural and petrographical characteristics support the idea that the real boundary of the southwest Pacific passes through New Zealand, Kermadec, Tonga, Fiji, New Hebrides, Solomons, and on to the Admiralty Islands. He thinks that the land connection or approximation took place in the late Mesozoic or in the Pleistocene, probably both. The eastern Pacific islands are different in structure, nature and origin, and have derived their fauna and flora by chance migrants from the region just indicated. The headquarters of *Partula* are then in a permanently oceanic group.

[2] The Inheritance of Inverse Symmetry in Limnaea peregra. By Cyril Diver, assisted by A. E. Boycott and Sylvia Garstang. Journal of Genetics. March, 1925. Vol. 15, pp. 115-200.

Under the Sea, he represented the naturalist as picking up a reversed shell on a tropical shore, when just as he was gloating over his find, a stone thrown by a savage smashed it in his hand. In all my years of collecting, I have never met with an abnormally reversed specimen, but my brother S. C. Cockerell was fortunate in finding a pond in Surrey, where sinistral *Lymnaea peregra* were not uncommon. On one occasion, after we had been discussing the phenomenon, he plucked up courage to write to Professor Huxley, who replied kindly, but could give no explanation. In the forty years since that time, biology has been largely transformed, and if we do not yet know the "explanation" of reversed coiling, we at least know a good deal more about the subject and its genetic significance. Captain Cyril Diver, in the elaborate paper cited in the footnote, gives a full account of recent experiments with *L. peregra*, accompanied by a discussion of the theoretical bearing of the results.

Beginning with a general account of dextral and sinistral gastropods, he goes on to record the known cases of sinistral *L. peregra*. It is perfectly clear that the reversed coiling is not due to the external environment, but is controlled by germinal factors. In several cases particular ponds have produced numerous sinistral shells, though dextral ones were always far more numerous. Extensive breeding experiments with sinistral *L. peregra* were started and carried through with the cooperation of several workers, residing in different parts of England and Wales. It was found that fertile eggs were readily obtained from single, isolated individuals. The question arises whether such cases represent parthenogenesis, or self-fertilization. The character of the inheritance shown by the offspring indicates the latter. The cross-breeding of individuals of opposite coiling was not practicable, but sinistrals could be crossed with sinistrals, dextrals with dextrals. In general, isolated snails gave either all dextral or all sinistral offspring, and when a pair gave half and half, it was found that the dextrals were from one parent, the sinistrals from the other. However, isolated individuals would give sinistrals with few odd dextrals, or the reverse. It is indicated, but not yet proved, that certain crosses of heterozygous individuals give a 3 to 1 ratio.

It is shown that the direction of the spiral is determined at the very beginning of development. In fact, it appears to be a property derived from the cytoplasm of the egg cell, the "cytoplasmic prelocalization" described by E. B. Wilson. This does not mean that there is no control by nuclear determiners; such control exists as it does for other characters, only the properties of the egg-cytoplasm are those due to the chromosomal complex of the egg-producer, regardless of the sperm introduced at fertilization. Thus a dextral snail may produce all sinistral offspring, the character of the latter being determined by its chromosomes, while its own character was determined by the chromosomes of its parent. This seems very extraordinary at first sight, but is quite intelligible, and appears to be fully supported by the evidence.

How comes it, then, that some broods are not uniform, and what is the meaning of the occurrence of strange monstrosities such as are figured on plate V? It is set forth that the dextral condition is not to be regarded as dominant to sinistral, in the usual Mendelian fashion. They are rather to be thought of as approximately equal but opposing forces, in heterozygous individuals. Were they exactly equal, a bilaterally symmetrical animal should result, but this does not happen. One or the other type predominates, but exceptions occur, and the monstrosities may be related to the internal struggle. However, the author develops a supplementary hypothesis of "suppressed" inheritance, and after assembling the evidence concludes that broods mostly sinistral with a few dextrals are "suppressed" dextrals, and those mostly dextral with a few sinistrals are "suppressed" sinistrals. He further supposes that the inherited germinal constitution may acquire a power of resistance to the nuclear factors, as a result of "selective breeding, isolation and time"; in other words that the cytoplasmic properties of the egg-cell may not be due simply to the parental germ-plasm, but to the accumulated effects of past generations. In all this, we pass into a region of speculation, where many will hesitate to follow. It would perhaps be possible to add another hypothesis, namely that whereas the character of the sperm did not ordinarily affect the coiling of the zygote pro-

duced at fertilization, the "prelocalization" might at times be insufficient or its effects delayed, so as to allow the sperm to play its part. At all events, the experiments are proceeding, and it is quite certain that Captain Diver and his associates have opened up a quarry rich in possibilities for discovery; one which has already given us at least one important contribution to the theory of heredity. The principle of deferred inheritance, or dominance by the parental cytoplasm, is fully recognized and elucidated by Wilson (The Cell, Third Edition, 1925), who further remarks, "it is evident that every character is produced during development by an activity in which the cytoplasm, and what we call the 'organism as a whole' plays a most important part." Wilson, following Sturtevant, gives a very clear statement of the *Lymnaea* case (t. c., p. 1109), remarking that "these curious relations, at first sight so mysterious, at once become perfectly plain when we perceive that the effect of the sperm-chromosomes is delayed for one generation."[1] Nevertheless, there are other complexities which at present do not "become perfectly plain," and it is through the intensive study of these that further important theoretical advances may be expected.

It is difficult to understand why Gwyn Jeffreys is throughout called "Jeffries," and on p. 198 Conklin is called Conklyn."

A NEW TEXAN BULIMULUS

BY JAS. H. FERRISS

In 1924, passing through Sanderson, a place on the Southern Pacific route west of the Pecos River, I found numerous specimens of a Bulimulus which was at once recognized as new to me. By a curious accident, the shells went astray, only a broken one, noticed in NAUTILUS, vol. 38, p. 41, was to be found when I got home. This year more were taken.

[1] In a similar manner, the color of silkworm eggs appears to be controlled by maternal influences regardless of the sperm. (Rettew, 1925.)